

Maps and Locals Workshop Report

Workshop Dates: Oct 7-10, 2010

**Submitted by Gary Kofinas, University of Alaska Fairbanks,
with Robert (Gil) Pontius, and Nathan Sayer (workshop co-conveners)**

The Maps and Locals (MALs) workshop was held on the campus of the University of Alaska Fairbanks (UAF) October 7-10, 2009 and involved 29 participants from 12 LTER sites, with 15 individuals coming from outside of Alaska and 14 being affiliated with UAF. (See Table 1 for participants; see Table two for agenda.)

MALs is funded by LTER Social Science Supplement grants of the National Science Foundation with the following objectives:

- To use spatial representation of land cover and land use to identify patterns of landscape change in regions in and around LTER sites
- To integrate local ecological knowledge (LEK) and other existing social data with spatial analysis into theories and models of social-ecological change to understand their implications to human livelihoods and well being.
- Participating LTER sites are to emphasize these activities to varying degrees with the goal of making cross-site comparisons and setting the stage for future cross-site comparative studies.

The MALs project and the workshop were motivated by the dramatic and rapid changes being observed across the LTER network and the need to understand these changes in the context of a “couple social-ecological systems” (SES) framework. The current state of SES science suggests there is a critical need for more robust interdisciplinary approaches to investigating human-environment interactions. Following from these needs, the MALs group hypothesized that the integration of spatial analysis (maps) and local knowledge provides an enhanced approach for 1) understanding change, 2) accounting for its complexity, 3) and achieving salience in research.

The objectives of the Fairbanks MALS workshop were to share LTER experiences to date, assess findings and methods on mapping and for integrating local knowledge with spatial analysis, and begin the process of identifying common science questions for future investigations. As well, the workshop was to provide an opportunity for face-to-face exchange of ideas on methods and research, to review of the spatial analysis previously completed by Robert (Gil) Pontus et al at Clark U, and to discuss ideas for promising future research.

Workshop Transactions:

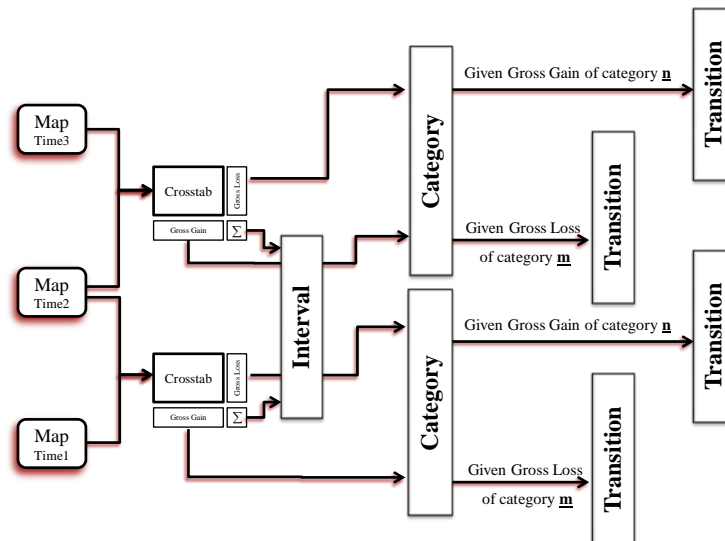
Sharing experiences at individual LTER sites:

The meeting began with presentations by a participant from each participating site, in which individuals described their system and changes, the types of spatial analysis underway at each site, and the ways social science and local knowledge are being employed. Below is a summary of the presentations.

LTER site	Critical driver(s)	Spatial analysis	Social Science/ Local Knowledge
Andrews	Post logging restructuring of system	Land use mapping	Interviews with “old timers”; survey research; institutional analysis
Arctic	Oil development and climate change	Historic land cover maps from oil industry	Interviews with locals (including oil field workers) on changing subsistence resource availability
Bonanza Creek / Interior Alaska	Climate change; increased fire frequency	Retrospective and prospective maps generated by model	Group interviews with indigenous harvesters
Central AZ-Phoenix	Urban sprawl and climate change	Fragmentation; land use change	Institutional research; environmental justice, risk and vulnerability; comparative urban research
Coweeta	Density change, demographic change	Multiple methods of analysis (view sheds, watersheds, participatory mapping)	Individual choice; documenting local knowledge of historic change; perceptions of change in “small town” character
FL Coastal Everglades	Land conversion, water budgets	Historic cadastral mapping	Ethnographic analysis and other forms of social science
GA Coastal	Land use and water level changes in estuary and marine ecosystem dynamics	Use of SLAMM (Sea level affects marshes model) with other tools	Limited to no social science involvement
Jornada	Vegetation; land use change; grazing legacies	Maps with repeat photography	Ranchers’ knowledge of change tied to changes in land-use practices.
Plum Island	Increases in density and type of residential uses	Density mapping;	Group truthing with visual verification and GPS field work
Konza	Land use change, woody invasions; exurbanization and loss of traditional ranching and agriculture	Multiple spatial analyses of agrarian transition	Semi-structured interviews of farmers & ranchers and other local specialists
Niwot	Woody encroachment; mountain pine beetle outbreak; changes in snowpack and runoff	Acquisition and orthorectification of aerial photos; land cover maps	Analysis of socio-economic data

Spatial Analysis of individual sites as completed by Pontius et al at Clark University:

During the course of the previous year, each participating MALS site contributed maps of three points in time, which were compiled and analyzed by Robert (Gil) Pontius and his students at Clark U. Pontius et al developed and applied a simple tool for analyzing percentage of land cover change. At the workshop Gil's summarized that work and highlighted with an illustration from Plum Island the need for an interaction of spatial analysis and local interpretation to understand fully the drivers of change. The full set of the spatial analyses completed by Pontius et al is located at the MALS website at http://www.lter.uaf.edu/bnz_MALS.cfm as PDFs of posters. These posters were developed by Clark graduate students and presented at the 2010 American Association of Geographers conference in Washington. The figure below illustrates the analytical tool developed by Pontius to calculate land cover change and a key question addressed in his analysis.



How do the intensities of each transition vary among losing categories available for that transition? (R Pontius)

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Discussions on research questions, methods, and salience:

The workshop identified several challenges associated with the MALS enterprise. These are summarized below by category:

1. Identifying the common issues, types of change, forces of change: While land-use change is important in some areas (e.g., greater impervious surface creating greater incidents of damaging floods), climate change, with its patterns of pulse and press

dynamics, is the critical issue in other areas (e.g., the Arctic). In other regions, human responses to change may be a critical driver. The individual presentations helped to illustrate the level of heterogeneity across and within sites.

2. Characterizing change across Social-Ecological Systems (SESs). What is the best currency for understanding trends and rates of change, and comparing SES dynamics across sites?

It was noted that three dimensions could serve to capture some comparisons:

- *Drivers*
 - Demographic change (who are the “locals?”);
 - global economic change;
 - climate change
- *Issues*
 - Fragmentation;
 - Changing Ecosystem Services;
 - Conditions of Inequity;
 - Changes in disturbance regimes
- *Dynamics:*
 - Thresholds;
 - Feedbacks;
 - Reversibility (toggle, inertia).

As a part of these discussions, the group explored how “degree of couplings” or “quality of coupling” could serve as an overarching approach for comparison of LTER sites social-ecological conditions. A suggested and illustrative hypothesis for analysis was suggested: *The greater the human dominance, the great the decoupling with regional ecosystem services*. This idea and other science questions provide for rich discussions. These are other questions are listed below:

- How does degree of “coupledness” affect responses to change?
 - How should we best characterize coupledness?
 - How does coupledness of rural and urban (and exurban areas) differ?
- How does LK feedback into decisions about LULC?
 - What kinds of knowledge do different kinds of locals have about the SESs in which they live? (livelihoods; tenure; w/ science)
 - How do LK and science based spatial analysis compare in quality of information and type of information generated?
- How does rate of change affect responses to change?
- How is global change affecting local places?
- What systems are more resilient to change?
- When is adaptation adequate and when is transformation necessarily?

- What are the mechanisms in transitions to points off no return vs ephemeral change?
1. Making the questions operational. (Also see breakout notes at the end of this report)
Many of today's theories of social-ecological change offer metaphorical insights, but are problematic when seeking to operationalize theory in rigorous empirical analysis. Rich workshop discussions and a breakout group addressed methodological questions related to our work.
 - a. How (where) can local knowledge best contribute?
 - b. How do we best integrate?
 - c. Need for common protocol for documenting LK in a cross-site study
 - d. Capacity to engage in LK (and LEK) research differs by site
 1. However there are several excellent examples such as the "Global Changes in Local Places" project.
 2. Making MALS relevant. Relevance is in part achieved through connecting the study of ecosystems to livelihoods and human well being. Part of this process is identifying successful strategies and problematic bottlenecks, and knowing when it is better to adapt or transform the system. Equally critical is engaging "locals"
 3. Being interdisciplinary: Interdisciplinary enterprises makes for strange bedfellows and a suite of challenges. While much is written and known about the process of doing interdisciplinary research successfully, acknowledging its tar pits from the outset is important.

Recommended future actions:

- With much of the initial spatial analysis complete, refocus the efforts on the use of LEK in MALS research
- Convene a panel of MALS investigators at the 2011 AAG conference (Seattle) to share aspects on the MALS experience and specifically focus on the use of local knowledge.
- Complete a literature review on the use of local knowledge and maps to understand land use land cover change.
- Draw on that work to jointly write and publish a paper on this topic
- Build on workshop discussions to develop and submit an NSF Coupled Human-Natural Systems Grant; explore other funding opportunities.
- Request funds to convene a second workshop in 2011

Table 1 – Participants		
First	Last	LTER site
Michaela	Buenemann	Jornada
John	Chamblee	Coweeta
Hannah	Gosnell	Andrews
John	Harrington	Konza
John	Hobbie	Arctic
Hope	Humphries	Niwot
Tim	Inman	Andrews
Barbara	Nolan	Jornada
Laura	Ogden	FL Coastal
Gil	Pontius	Plum Island
Nathan	Sayre	Jornada
JP	Schmidt	GA Coastal
John	Van Castle	LTER Network Office
Matt	Vogt	Andrews
Abigail	York	Central AZ-Phoenix
Terry	Chapin	BNZ - UAF
Gary	Kofinas	BNZ and ARC UAF
Eleanor	Wirts	UAF
Skip	Walker	ARC - UAF
Martha	Reynolds	ARC- UAF
Dave	Verbyla	UAF
Shauna	Loshbaugh	UAF
Corrie	Knapp	UAF
Colette	deRoo	BNZ & ARC UAF
Todd	Brinkman	BNZ & ARC UAF
Shauna	BurnSilver	BNZ & ARC UAF
Jen	Schmidt	BNZ - UAF
Roger	Ruess	BNZ - UAF

Table 2 – Workshop Agenda		
<i>day</i>	<i>time</i>	<i>activity/topic</i>
Thursday	all day	people arrive and settle in; take cab to hotel; your expense.

Friday	6:30 to 7:30	Breakfast at the hotel
	7:45	Van leaves hotel for UAF
	8:15	introductions
	8:45	Workshop charge and background on MALS
	9:15	overview on map analysis
	10:00	open discussion about map analysis
	10:30	coffee break
	Site Presentations	
	10:45	Central AZ/Phoenix
	11:00	Cowetta
	11:15	GA Coastal
	11:30	Jornada
	11:45	FL Coastal
	12-1:30	lunch
1:30	Konza	
1:45	PIE	
2:00	Niwot	
2:15	Konza	
2:30	"Then & Now" Exhibit at the UAF Museum of the North	
4:00	coffee break	
4:15	Arctic	
4:30	Bonanza Creek	
5:00	Open discussion / reflections on similarities and differences	
6:00	End meeting for the day	
6:30	dinner at Chena Pump House	
Saturday	7	Breakfast at the hotel
	7:45	Van leaves hotel for UAF
	8:15	Day's charge
	8:30	Grad Students report on impressions fr yesterday
	9:00	breakout - Issues and science questions
	10:00	Report back
	10:30	coffee break
	11:00	breakout - Analytical Framework
12:00	lunch	
1:00	report back	

	1:30	breakout- work plans
	2:30	Report back
	3:00	paper themes
	4:30	open dicussion
	5:30	End meeting
	7:00	dinner at Gary's house
Sunday	7	breakfast on your own (your cost)
	8:00	van pick up for field trip
	8:30	Permafrost tunnel
	10am	Visit musher
	1	Chena Hot Springs lunch
	2	CHS tour
	3	soak
	4:30	return to FAI
	6	must return by this time
		dinner on your own - hang out to wait for flights and return to hotel for those staying over

Submitted notes from Breakout group discussions:

Breakout group #3 on Theory (summarized by J Harrington)

Theoretical grounding of the Maps and Locals project lies in the realm of land change science wherein proximate causes and underlying driving forces are examined. Local knowledge is key in deciphering changes that occur at the scale at which decisions are made (i.e., the local scale). Conversations with local stakeholders will help unravel the relative importance of endogenous and exogenous factors as well as fingerprinting the relative importance of natural versus social drivers of change. For example, a forest fire may have lightning cause ignition, but the current fuel load might be related to both recent weather patterns and well as a longer term forest management policy. In another example, exurban development and an associated change in ecosystem services may be related to a combination of institutional/policy decisions and cultural preferences.

Much of the work on ecosystem services has been either in looking at the systems science associated with a given service or a qualitative discussion of services at a given location and how those services are changing over time. Recent developments in modeling changes in ecosystem services, with software such as *InVest* allow a transformation to more economic and

quantitative assessments of ecosystem services. Quantification of the ecosystem services greatly enables communicating to a broader audience the value of the services and how those values might be changing. Assessment of changes in ecosystem services can assist in identifying situations where a specific location and specific operating mindset might be 'heading toward a train wreck' and then lead to making informed decision toward appropriate management changes. The MALS team is now well positioned to quantify changing value of ecosystem services across a variety of study sites.

A number of conceptual frameworks such as vulnerability and tipping points can be used in conversations with stakeholders to assist in unraveling the depth of local knowledge. Trends in local land cover change can lead to transformation that produces to a regime shift. Stakeholder examination of existing local knowledge about the coupled natural and human system and its drivers can help avoid potential shift to an alternative stable state which would require inordinate investment to return to prior conditions. Maps of change can assist in developing ideas about current system characteristics and trends. Results from the multiple MALS efforts can be used to examine similarities and differences across the sites.

Stakeholders have an important role to play in adopting management strategies for their local area. Assessments of land use and cover change, related changes in ecosystem services, and related social system operations will enable decision making regarding alternative futures. Scholars who have been working on aspects of coupled natural and human systems suggest that there is a need for empirical work across a variety of sites to help validate the theoretical ideas that have dominated thinking to-date. The LTER cross-site effort on Maps and Local is well positioned to undertake this effort. Existing expertise in both land cover change analysis as well as in understanding local environmental knowledge are related to those changes and are needed to understand them.

Below are examples of past studies that will inform future MALS research:

Global Change in Local Places [Wilbanks & Kates 1999] present six arguments on why scale matters:

- the tractability argument -- "central relationships underlying global change are too intractable, too complex, to trace at any scale beyond the local ..."
- the perspective argument -- "Differences in perspectives between 'macro' and 'micro' provide many examples of situations where researchers looking at an issue top-down come to different conclusions from those looking at the issue bottom-up."

Geist and Lambin 2002 *Proximate Causes and Underlying Driving Forces*

- proximate causes = infrastructure extensions, ag expansion, wood extraction, other (includes biophysical and social trigger)

- drivers = demographic, economic, technological, policy & institutional, cultura

Complexity of coupled human and natural systems [Liu et al. 2007]

- "most of the previous work has been theoretical rather than empirical"
"future research on coupled systems must include not only separate site-specific studies but also coordinated, long-term comparative projects across multiple sites to capture a full spectrum of variations"
- "as globalization intensifies, there are more interactions among geographically distant systems and across scales"

Global Consequences of Land Use 2005 Foley et al.

- "Land use thus presents us with a dilemma."
- "Are land-use activities degrading the global environment in ways that ultimately undermine ecosystem services ... ?"
- "Developing and implementing regional land-use strategies that recognize both short-term and long-term needs, balance a full portfolio of ecosystem services, and increase the resilience of managed landscapes will require much more cross-disciplinary research on human-dominated ecosystems."

Breakout Group #2 – Value and use of local knowledge

- Requirements
 - Feasible across sites and given resource constraints
 - Scientific merit (land change science)
 - Broader impact (inform policy- and decision-making)
 - Research Questions
 - How does our understanding of land change improve with stakeholder involvement? Do we gain a better understanding of the nature of drivers involved (the “what”) or of spatial details (the “where”) or of both?
 - What is driving change according to locals? What are the agents that help drive change (e.g., first adopter on social science side, drought on natural science side)? What are the presses/pulses; slow/fast variables; chronic/acute drivers at different temporal and spatial scales?
 - How are changes perceived? What do locals perceive as the major problems?
 - What is the perceived impact of changes on people / environment? What is the impact of changes in infrastructure on local environment? What are the time frames involved? How does that change the way people interact?
 - What would future landscapes look like according to stakeholders? What is the

value of ecosystem services to different stakeholders? How strongly connected do locals feel to landscape elements? What changes do locals want to see in the future? How does the integration of maps and locals affect desired outcomes in natural resource management? --- What-if scenarios ...

IMPORTANT: The broad discussion we had concerning maps and ethnography suggests a real need for a group review of Participatory GIS literature that is directed at find the best potential ways to link local knowledge and remotely sensed maps.

With regard to data, most of that discussion focused on the needs related to characterizing sites. However, it was also suggested that, for some comparative analyses, we need a common unit -- a common grid-size and that would allow an analysis with the common grid. Such an analysis will be impacted from where grid cells begin and end, but this may be worthwhile anyway.

Since any standardized approach trades local detail for comparative value, it may be best to standardize in a hierarchical way, so it will be possible to maintain both local and global value. Delcourt provides a potential approach. The scale of the sites would be crucial in determining how a hierarchical standard might be applied.

Breakout group #3 notes: Making the MALs Analysis Operational

The discussion covered three main topics:

- 1) Site Characterization,
- 2) Local Ecological Knowledge and
- 3) maps and data.

The discussion focused on each topic, but, in addition to being covered in a direct discussion, maps and data were also frequent discussion points in terms how we might accomplish concrete goals related to the first two topics.

Site Characterization

Early in the meeting, we agreed that multi-dimensional site characterizations would be preferable to a single classification scheme that arrays sites along a only one axis of variation. There are four primary reasons for preferring the former approach to the latter:

- 1) Sites are internally heterogeneous. When any single gradient is applied, one portion of the site may be best characterized at one point on a gradient, while another portion falls elsewhere.

2) Sites vary dramatically according to scale so there are some types of gradient that will not allow meaningful comparisons.

3) A multidimensional analysis will allow us to detect comparative differences that could, in and of themselves, provide some insights about potential drivers of social/ecological change across sites.

4) A multidimensional analysis provides the opportunity to build a classification empirically.

Specifically, it was suggested that a variable-based, multi-dimensional approach could provide the opportunity to differentiate sites using discriminating analysis. This approach would empirically ground the classification and it would allow us to toss out variables that are not meaningful in terms of defining variation. In addition, we would have an index for all sites that could inform some of the local knowledge we might be going after and possibly allow some preliminary discussion about hypothesized drivers of change.

In addition to talking about the potentials of a multi-dimensional approach, the discussion covered the kinds of variables we might want to collect to characterize the sites. The discussion was wide ranging, but did result in lists of variables that can be grouped together. The groupings are based on the type of data and are presented below, along with the lists of variables.

Basic Data Already Publicly Available at All Sites

- Extent (area), Terrain (a DEM), Demographic and Socio-economic indicators, Biome, Climate
- *Characteristics of our Existing Land Cover Maps based on Categories*
- Resolution, Number of categories, heterogeneity, fragmentation, and diversity during a single time period, dominant LC class.

Types of Change calculated using existing MALs software

- Speeding up or Slowing Down?
- At different places or at the Same Places?
- Stable vs. Unstable over time?

Types of Land Cover Category Change

- change cover category percentages, Dominant category shifts?

Local Knowledge Variables

- Number of Agents involved decision-making, dominant decision making bodies/approaches regarding land use, perceptions of change, vulnerability to change (these last two depend heavily on the questions asked).

Local Ecological Knowledge

- Much of the discussion concerning LEK was related to the kinds of questions we might ask and the problems we might encounter when asking them. If the goal of the project is to understand connections between global drivers, local drivers, and local change the significant variation in scale across MALs presents a challenge. Researchers working in a study area with 500,000 people will get different reactions from those working in areas with 500. Experience suggests that the scale of the study may matter in part because the scale of the study area matters.
- A second question related to LEK asks what we expect to get by using maps to elicit LEK. One suggestion is that LEK can inform us about our existing maps and may provide kind of “ground truthing.” We will also want to learn why locals think change happened, how the change is experienced by the community and what the feedbacks might be for local ecology. We can also ask open questions about the kind of changes people have seen. Experience suggests that when people are asked about effects of change, the descriptions start out with discussions of direct effects and move to those that are indirect.

Maps and Data

- The specific discussion about maps and data was broadly split into a maps discussion and a data discussion. The maps discussion centered on the use of maps in the field and broad approaches to designing maps.
- The fieldwork portion of the discussion covered the topics of scale and ethnographic method. With regard to scale, it is understood that people are likely to have different reactions to maps of different scales. Maps covering large areas tend to fit with people’s general perceptions, while, at finer scales, people start taking issue with the maps or start talking about specific historical events that led to change. A few people will challenge maps. This can be very instructive.
- There was a broad discussion regarding the mechanics of using maps to solicit information. Some may show up with paper maps in hand. These may or may not be maps printed from the GIS. It was suggested that people have a much easier time comprehending aerial photographs and that photos are a richer cartographic dataset. However, aerial photographs must be used with caution. You may not want to show up cold at an interviewee’s home with an aerial photo of their property. Perceptions of privacy are important. It may also be possible to use multiple maps -- it boils down how to characterize the phenomenon and the cartographic tools you use. However, we must also remember that maps are cultural artifacts and are, in and of themselves, part of theory. You will have different interactions with informants, depending on the maps you use.